DOE Hydrogen Program

Hydrogen Fueling—Coming Soon to a Station Near You

Hydrogen-fueled vehicles are becoming a more common and important part of a cleaner and more sustainable transportation future. The development of a network of hydrogen-dispensing fueling stations is essential to enable further progress. For local regulatory agencies, this future poses the challenge of applying codes and standards to allow safe but expeditious permitting of new hydrogen fueling stations, as well as the addition of hydrogen fueling at existing gasoline stations.

While hydrogen is a new and different fuel for vehicles, it is used extensively in other applications, such as a chemical feedstock and to power space exploration. The experience of hydrogen fueling station developers and vehicle manufacturers is still limited, but as the successful examples in the box on the next page show, hydrogen is an established fuel that is fully safe if handled properly as all fuels must be.

Experience in permitting hydrogen fueling stations is thus far limited to a few states and local governments. However, enough stations have been built so that local jurisdictions do not have to reinvent the wheel. As of fall 2007, there were more than 60 stations in the United States, with many others planned or in the process of obtaining permits. Clusters of multiple stations are located in the Greater Los Angeles, Greater San Francisco Bay, and Detroit metropolitan areas. The majority of existing stations were built for fleet applications and facilities, but some also serve other customers or are open to the public. Databases maintained by the National Hydrogen Association at www.hydrogenassociation.org/general/fuelingSearch.asp, Fuel Cells 2000 at www.fuelcells.org/info/charts/h2fuelingstations.pdf, California Fuel Cell Partnership at www.fuelcellpartnership.org/fuel-vehl_map.html, and a German consulting company at www.h2stations.org provide more complete lists.

In approving permits for these stations, state and local jurisdictions have used existing codes and standards available from organizations such as the International Code Council (ICC) and the National Fire Protection Association (NFPA). In recent years, the ICC has adopted more specific provisions for hydrogen fueling stations in its International Fire Code and the NFPA has consolidated and updated key hydrogen standards as noted in the box on the next page. In addition, the U.S. Department of Energy has begun a major effort at the national level to help facilitate the permitting process for hydrogen fueling stations. Individual states such as California and Michigan have similiar efforts at the state-level. This fact sheet is one product of DOE's national effort. For more information, please refer to the information sources or contact the persons listed at the end of this fact sheet.

Many other resources are available from the U.S. Department of Energy's Hydrogen, Fuel Cells & Infrastructure Technologies Program and other organizations to help prospective hydrogen fueling station developers and local code officials.

Guidebooks:

- Sourcebook for Hydrogen Applications. 98 p. A full description of hydrogen's properties and safe systems for its use. Paper and CD versions, but only CD is updated. Available from TISEC Inc. www.tisec.com/
- Guide to Safety of Hydrogen and Hydrogen System. American Institute of Aeronautics and Astronautics. G-095-2004. 236 p. An American National Standard, comprehensive specific information and guidelines for safe handling of hydrogen. www.aiaa.org/content.cfm?pageid=178

Web Sites:

- Safety, Codes, and Standards at www.eere.energy.gov/hydrogenandfuelcells/codes/ prepared by the DOE Hydrogen, Fuel Cells & Infrastructure Technologies Program — general background, information about the DOE program, links, and safety animations
- Hydrogen and Fuel Cell Safety at www.hydrogenandfuelcellsafety.info — monthly update of codes and standards activities

The Shell hydrogen fueling facility in Washington, D.C., is now one of a handful of such stations in the United States, but more are being built each year in this country and around the world. Local jurisdictions can benefit greatly from the experience of other local authorities who have already gone through the permitting process.

NREL/PIX 14917

Hydrogen Fueling Station Examples

Public Retail Stations

- Shell Benning Road Station, Washington, D.C.; retail station renovated to include hydrogen (delivered as liquid) and gasoline; operational since November 2004

Fleet and Research Facilities

- Arizona Public Service Hydrogen Pilot, Phoenix, AZ; fleet facility using delivered gas and onsite generation; operational since March 2002
- LAX Airport Station, Los Angeles, CA; fleet facility with onsite generation; operational since October 2005
- NextEnergy Center Hydrogen Station, Detroit, MI; multi-fuel research facility; fleet facility; operational since October 2006
- City of White Plains Hydrogen Refueling Station, White Plains, NY; city fleet facility; operational since October 2007
- California Fuel Cell Partnership, West Sacramento, CA; research vehicle service using delivered liquid hydrogen; operational since 2000

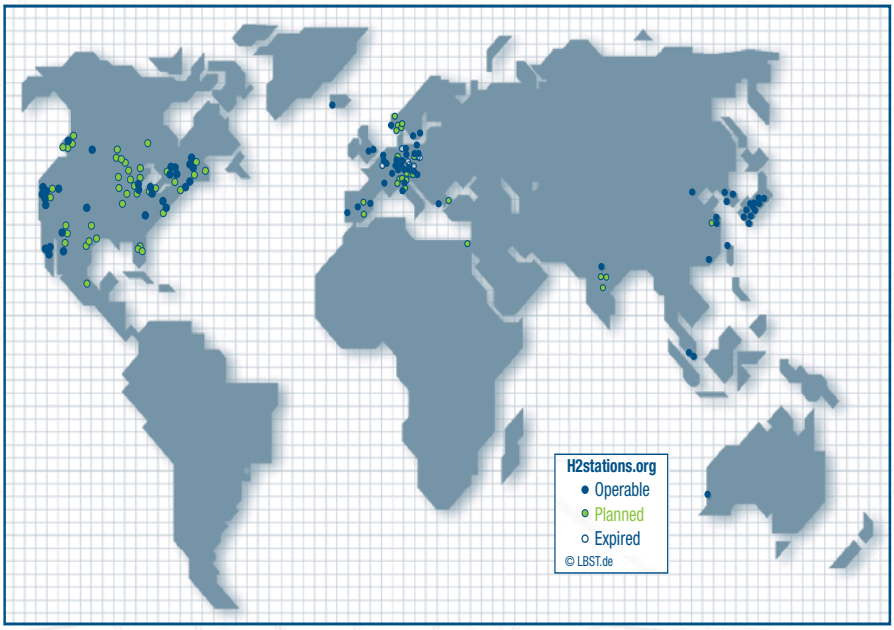
Bus System Stations

- AC Transit Hydrogen Fueling Station, Oakland, CA; fuel cell bus fleet facility with on-site generation; operational since November 2005
- Progress Energy Florida Orlando Airport Station; Orlando, FL; hydrogen internal combustion bus fleet demonstration project; operational since May 2007
- SunFuels Station, Thousand Palms, CA; services fuel cell and hydrogen internal combustion buses and others; operational since April 2000.

- National Hydrogen Association at www.hydrogenassociation.org/index.asp — general resource for information and contacts
- Hydrogen Codes and Standards Portal at hcsp.ansi.org/ — prepared by a collaboration of DOE, NREL, and American National Standards Institute; links to specific codes applicable to fueling stations and other aspects of hydrogen and fuel cell technology (limited code links as of this writing)
- Hydrogen and Fuel Cells Permitting Guide at www.pnl.gov/fuelcells/permit_guide.stm — prepared by a collaboration of DOE and code development organizations; specifically addresses the process of local permitting of hydrogen fueling stations and stationary fuel cells, includes detailed table of applicable codes
- Hydrogen and Fuel Cell Standards Matrix at www.fuelcellstandards.com — listing and status of key standards, calendar of meetings, Q&A
- Hydrogen Incidents Database at www.h2incidents.org — information on hydrogen incidents and lessons learned
- Hydrogen Safety Best Practices online manual at www.h2bestpractices.org — recommended procedures and equipment for safe use of hydrogen
- Hydrogen Safety Bibliographic Database at www.hydrogen.energy.gov/biblio_database.html — publications related to hydrogen safety
- California Fuel Cell Partnership at www.fuelcellpartnership.org/index.html — general background and current information on California hydrogen fueling and vehicles
- The U.S. Fuel Cell Council at www.usfcc.com/resources/technicalproducts.html — hydrogen safety and other brochures and reports

Hydrogen Fueling Station Network

Permitting a facility for a new technology such as a fueling station for hydrogen-powered vehicles may seem daunting at first. However, you can benefit from the experience of those who have already done so. There are already more than 50 operational hydrogen fueling stations in the United States and many more throughout the world. The table below provides examples of types and locations of facilities that might be similar to proposals submitted to you. The contact people listed are willing to share information about their experience permitting hydrogen fueling stations in their jurisdictions and to answer questions that might help you with proposed stations in your jurisdiction.



Station	Description	Permitting Contact
California		
AC Transit Hydrogen Fueling Station, Oakland, CA	Two-and-a-half-year demonstration project to service three fuel cell buses (more planned) and also research fuel cell passenger vehicles; on-site gas reformation; open since November 2005	Leroy Griffin City of Oakland Assistant Fire Marshal 510-238-7759 lgriffin@oaklandnet.com
Santa Monica Hydrogen Fueling Station, Santa Monica, CA	Five-year demonstration project on city property to service five hydrogen internal combustion engine conversions; on-site electrolysis adjacent to existing CNG fueling facility; hydrogen storage on top of CNG tanks; open since June 2006	Jim Glew City of Santa Monica Fire Marshal 310-458-2201 x8782 jim.glew@smgov.net
SunLine Transit Agency Hydrogen Fueling Station, Thousand Palms, CA	Ongoing project on transit agency property to service two SunLine buses (one fuel cell and one hydrogen internal combustion; more planned) plus fleet and research vehicles; on-site gas reformation; open since April 2000	Walter Brandes Riverside County Assistant Fire Marshal 760-863-8886 walt.brandes@fire.ca.gov
LAX Airport Station, Los Angeles, CA	Demonstration project on airport property to service airport fuel cell vehicles; on-site electrolysis; open since October 2005	Construction Services Unit City of Los Angeles Fire Department 213-482-6900
California Fuel Cell Partnership, West Sacramento, CA	Ongoing facility servicing variety of research vehicles; using delivered liquefied hydrogen; open since November 2000	Fred Postel City of West Sacramento Fire Chief 916-617-4600 fredp@cityofwestsacramento.org
District of Columbia		
Shell Benning Road Station, Washington, DC	Ongoing public fueling facility as part of retail gasoline station; using delivered liquefied hydrogen, dispensed as liquid or compressed gas; open since November 2004	Richard Fleming District of Columbia Deputy Fire Chief 202-727-3659 richard.fleming@dc.gov
Florida		
Chevron/Progress Energy Boggy Creek Road Hydrogen Station, Orlando, FL	Five-year demonstration at new site with new building on utility property for hydrogen-fueled internal combustion shuttle-bus fleet; on-site gas reformation and delivery; open since May 2007	Thomas Hite Manager, City of Orlando Permitting Division 407-246-2525 thomas.hite@cityoforlando.net
Michigan		
NextEnergy Center Hydrogen Station, Detroit, MI	Ongoing facility at new site to service alternative fuel research center; using delivered hydrogen or on-site generation from research projects; open since October 2006	Derek Segars, City of Detroit Supervisor of Fire Protection Engineering, 313-224-1311 segarsd@dfdhq.ci.detroit.mi.us Marcia Poxson, Storage Tank Unit Engineer, Michigan Department of Environmental Quality, 517-373-3290, poxsonm@mich.gov
New York		
City of White Plains Hydrogen Refueling Facility, White Plains, NY	Ongoing facility on city property for city hydrogen-fueled internal combustion fleet and blending with CNG; dispensing pump on common island with other fuels; on-site electrolysis; open since October 2007	Joseph (Bud) Nicoletti Commissioner of Public Works/City Engineer 914-422-1210 jnicolet@ci.white-plains.ny.us
Nevada		
Las Vegas Hydrogen Energy Station, Las Vegas, NV	Ongoing facility on city property started as demonstration project to service city vehicles; using delivered liquefied hydrogen; open since August 2002	Earl Russell Deputy Director of Building and Safety 702-229-6092 erussell@lasvegasneveda.gov

Major Codes and Standards Applicable to Hydrogen Fueling Stations

Several model codes have now been developed specifically for hydrogen fueling stations. Most notable are Section 2209 of the 2006 International Fire Code (IFC) and NFPA 52, Chapter 9 of the 2006 National Fire Protection Association (NFPA). Both of these codes, in turn, reference other codes for specific equipment or other requirements. Selected key codes:

- Section 2209, "Hydrogen Motor Fuel-Dispensing and Generating Facilities," 2006 International Fire Code, International Code Council*
- Chapter 9, "GH2 (Gaseous Hydrogen) Compression, Gas Processing, Storage, and Dispensing Systems," NFPA 52, the 2006 Compressed Natural Gas Vehicular Fuel Systems Code, National Fire Protection Association*
- Chapters 10 and 11, "Gaseous and Liquefied Hydrogen Systems," of NFPA 55 Compressed Gases*
- NFPA 30, NFPA 30A, "Motor Fuel Dispensing Facilities and Repair Garages"
- For storage of gases: IFC Chapters 30 and 35 and NFPA 52*
- For storage of liquids: IFC Chapter 32, NFPA 55, CGA P-18*
- ASME Boiler and Pressure Vessel Code BSPV-CC-BPV (American Society of Mechanical Engineers)*
- For piping: ASME B31.2 and CGA G-5.4 (Compressed Gas Association)*

*The International Fire Code and other International Code Council documents are accessible at www.iccsafe.org/. National Fire Protection Association documents are accessible at www.nfpa.org/freecodes/free_access_document.asp. American Society of Mechanical Engineers documents are accessible at store.asme.org/default.asp. Compressed Gas Association documents are accessible at www.cganet.com/publication.asp.

Contacts

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Safety, Codes and Standards

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